CLAIMS

What is claimed is:

1. An osmotic pump for providing sustained delivery of a beneficial agent, comprising:

a reservoir for holding the beneficial agent and an osmotic agent;

at least one wall defining a boundary of the reservoir;

at least one vent formed through the at least one wall;

a semipermeable membrane positioned to seal the at least one vent, the semipermeable membrane being capable of displacement relative to the reservoir when a threshold pressure in the osmotic pump is reached, wherein the vent is exposed to the osmotic agent and at least a portion of the osmotic agent is released from the reservoir when the semipermeable membrane is displaced relative to the reservoir.

2. The osmotic pump of claim 1, wherein the vent is sized to increase the exposed surface area of the semipermeable membrane by less than 1%.

3. The osmotic pump of claim 1, wherein the vent comprises an annular orifice having a diameter of less than 0.01 inches.

4. The osmotic pump of claim 1, wherein the vent is sealed from an environment of operation by a water impermeable material that is readily expelled as the vent is exposed to the osmotic material.

5. The osmotic pump of claim 4, wherein the water impermeable material comprises a wax or an oil.

6. The osmotic pump of claim 1, wherein the semipermeable membrane is friction fit within the reservoir.

7. The osmotic pump of claim 1, wherein the semipermeable membrane is configured for progressive displacement relative to the reservoir when a threshold pressure in the osmotic pump is reached.

8. The osmotic pump of claim 1, wherein the semipermeable membrane is configured as a plug with multiple retaining rings.

9. The osmotic pump of claim 1, wherein the reservoir is made of a non-bioerodible material.

10. The osmotic pump of claim 1, wherein the osmotic agent comprises an osmotic tablet.

11. The osmotic pump of claim 1, wherein the osmotic agent comprises an osmagent, an osmopolymer, or mixtures thereof.

12. The osmotic pump of claim 1, further comprising a filler distributed within the reservoir and around the osmotic agent.

13. The osmotic pump of claim 1, further comprising a movable piston located in the reservoir and between the beneficial agent and the osmotic agent.

14. The osmotic pump of claim 13, wherein the movable piston is formed of a noncompressible material.

15. The osmotic pump of claim 1, wherein the beneficial agent is selected from the group consisting of medicaments, vitamins, nutrients, biocides, sterilization agents, food supplements, sex sterilants, fertility inhibitors, fertility promoters, and combinations thereof.

16. The osmotic pump of claim 1, wherein the beneficial agent is formulated as a slurry, a suspension, or a solution.

17. An implantable osmotic pump for providing sustained delivery of a beneficial agent, comprising:

a reservoir for holding the beneficial agent and an osmotic agent;

a semipermeable membrane formulated to be permeable to the passage of external liquids and being capable of displacement relative to the reservoir when a threshold pressure in the osmotic pump is reached; and

a means for venting the osmotic agent out of the reservoir upon displacement of the semipermeable membrane.

18. The implantable osmotic pump of claim 17, wherein the means for venting the osmotic agent comprises a vent formed through a wall that defines a boundary of the reservoir.

19. The implantable osmotic pump of claim 17, wherein the means for venting the osmotic agent comprises a plurality of vents formed through one or more walls that define boundaries of the reservoir.

20. An osmotic pump for providing sustained delivery of a beneficial agent, comprising:

a reservoir for holding the beneficial agent and an osmotic agent;

at least one wall defining a boundary of the reservoir;

at least one vent formed through the at least one wall;

a means for removably sealing the at least one vent, the sealing means being capable of displacement relative to the reservoir when a threshold pressure in the osmotic pump is reached to expose the osmotic agent and release at least a portion of the osmotic agent the reservoir.

21. The osmotic pump of claim 20, wherein the sealing means comprises a semipermeable membrane.

22. The osmotic pump of claim 20, wherein the sealing means comprises a semipermeable membrane that is friction fit within the reservoir.

23. The osmotic pump of claim 20, wherein the sealing means comprises a semipermeable membrane that is configured for progressive displacement relative to the reservoir when a threshold pressure in the osmotic pump is reached.

24. The osmotic pump of claim 20, wherein the sealing means comprises a semipermeable membrane that is configured as a plug with multiple retaining rings.